M-X-128
ISSN 0704-769X

A TEST OF FIVE HERBICIDES AND THREE METHODS OF GROUND APPLICATION FOR CLEANING YOUNG STANDS AND CLEARCUT AREAS

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MARITIMES
CANADIAN FORESTRY SERVICE

87-01471/

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Information Report M-X-126

Canadian Forestry Service

Department of the Environment

1981

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ABSTRACT

Roundup (glyphosate), as a 20% solution in water, injected into trees with a hypo-hatchet at the rate of 2 mL per 2-3 inches of diameter breast high, was the most satisfactory herbicide and method of application tried, both for cleaning young stands of mostly spruce (Picea spp.) and balsam fir (Abies balsamea) to free the best trees for increased growth, and for killing unwanted residual trees, mostly hardwoods, on cutover areas. Other herbicides tried were Garlon, Hyvar, Krenite, and Velpar. Other methods of application were the spot gun using Hyvar and Velpar, and gridballs (capsules) containing Velpar.

RESUME

Roundup (glyphosate), solution à 20% dans l'eau, injecté dans les arbres avec une HYPO-HATCHET à raison de 2 mL par 2-3 pouces de diamètre à hauteur de poitrine, furent l'herbicide et la méthode d'application les plus efficaces parmi ceux qui furent essayés, que ce soit pour nettoyer de jeunes peuplements d'épinettes (Picea spp.) et de sapin (Abies balsamea) afin de libérer les meilleurs arbres et augmenter ainsi leur croissance, ou pour supprimer les arbres indésirables, feuillus pour la plupart, qui restent après la coupe. Les autres herbicides essayés furent Garlon, Hyvar, Krenite, et Velpar. Les deux autres méthodes d'application firent usage d'un vaporisateur à jet précis (spot gun) rempli d'Hyvar et de Velpar, et de petites capsules (GRIDBALLS) contenant du Velpar.

INTRODUCTION

In New Brunswick, cleaning young stands to free the best trees for increased growth is normally done with the powered brush saw. However, the use of herbicides may give satisfactory results at less cost.

Clearcutting in mixed wood stands is rarely as clear as the name implies: usually some trees are left standing because of defect, size, lack of markets, or other reasons. Past practice was to leave these trees while a new stand of regeneration grew up under and around them. Although residual trees are sometimes useful, they are often an obstacle to forest improvement. They may provide unwanted seed and shade, suppress and damage young trees, waste space, present a hazard to low-flying aircraft applying pesticides and fertilizer, and interfere with future harvesting. Present practice is to fell unwanted trees at or soon after the final harvest, or to leave them standing until the cutover is cultivated and planted to trees, then fell the residuals in winter when the snow is deep and firm enough to protect the planted trees. This is satisfactory except for cost. Using herbicides may be a more economical method of disposing of these residual trees until ways are found to use all trees.

Herbicides for cleaning young stands and disposing of residual trees on clearcut areas were tested in June 1979 on lands of Fraser Inc. in northern New Brunswick near Plaster Rock.

METHODS AND MATERIALS

Fraser Inc. provided the manpower and the equipment for applying the herbicides. Chemical companies and the New Brunswick Department of Natural Resources provided some herbicides and technical help. The Maritimes Forest Research Centre suggested herbicides, formulations, and methods of application, and assisted with mixing, supervision, and evaluation.

Fourteen small plots (12 x 12m) were established near Plaster Rock, N.B., seven in a young stand of mostly spruce (Picea spp.) and balsam fir (Abies balsamea (L.) Mill.) along the Wapske road; the remaining plots were in a cutover area with residual hardwoods off the Odell River road. Some plots were subdivided and there was some replication but no attempt at a formal statistical design.

Five herbicides were used, Garlon (triclopyr), Hyvar (bromacil), Krenite (fosamine), Roundup (glyphosate), and Velpar (hexazinone) (Table 1), with three methods of application, (a) tree injection with hypo-hatchet, (b) spot gun, and (c) gridballs dropped by hand.

The output of the hypo-hatchet (Fig. 1) was measured and found to be

Fig. 1. Hypo-hatchet

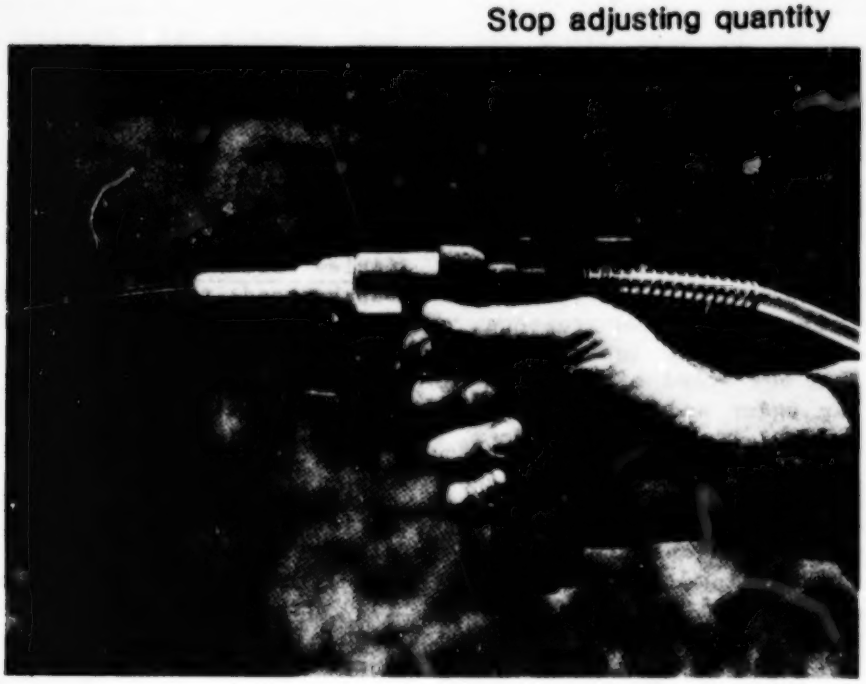

Fig. 2. Spot gun.

2 mL per hack. Three rates of application were used: low, 2 mL per 3 inches of stem diameter at breast height (dbh); medium, 2 mL per 2 inches dbh; and high, 2 mL per 1 inch dbh. The spot gun (Fig. 2) was used at 4 mL and 8 mL settings. The Velpar gridballs were dropped at a 4.25 foot square spacing, equivalent to 20 lbs per acre, on only one plot in the cutover area.

All herbicides were used undiluted except Roundup where Norwegian experience (Lund-hoie 1976)[1] recommended a 20% solution in water for hypohatchet use. In southern United States it is used undiluted (Mann 1979).

The herbicides were applied June 11-13, 1979. Equipment was washed thoroughly after each application. Results were assessed June 18-19, 1980, using the following response or condition rating.

1 = none
2 = light (about 25% of the crown dead or foliage slightly discoloured).
3 = medium (about 50% of the crown dead or foliage greatly discoloured).
4 = heavy (mostly dead; not expected to recover).
5 = dead (completely dead; no live crown).

[1] G.F. Weetman, Pers. Comm. University of New Brunswick. Present address: University of British Columbia, Vancouver, B.C.

Table 1. Herbicides and Manufacturer

Herbicide	Approximate cost ($) U.S. gal	Manufacturer
Garlon (triclopyr)	100	Dow Chemical Company
Hyvar (bromacil)	20	DuPont Canada
Krenite (fosamine)	34	DuPont Canada
Roundup (glyphosate)	75	Monsanto Canada Ltd.
Velpar (hexazinone)	40	DuPont Canada

The percentage of trees in classes 3 to 5 combined (medium damage to completely dead) determined the susceptibility rating of the tree species to the herbicide treatment, as follows:

0 - 32% = Resistant
33 - 66% = Intermediate
67 - 100% = Susceptible

RESULTS

Cleaning

Hypo-hatchet

Roundup, 20% solution, injected with the hypo-hatchet at the low rate (2 mL per 3 inches dbh) gave satisfactory results. Fir, spruce, white birch (Betula papyrifera Marsh), and aspen (Populus tremulodies Michx. and P. grandidentata Michx.) were killed or seriously damaged and rated susceptible (Table 2). Use of higher rates is unnecessary.

Undiluted Krenite also gave good results with conifers (Table 2) but not with hardwoods (Table 3), and is more expensive to use than Roundup.

Velpar, Hyvar, and Garlon were largely ineffective.

Spot Gun

The spot gun is non-selective[2] and therefore unsatisfactory for weeding and thinning these stands. Both herbicides used, Velpar and Hyvar, were moderately effective for killing and damaging some trees, especially spruce that we wanted to leave unharmed (Table 2).

Killing Residual Trees

Hypo-hatchet

Roundup, 20% solution, and Velpar and Garlon, undiluted, all at the medium rate (2 mL per 2 inches dbh), were effective for killing and seriously damaging aspen, white birch, and pin cherry (Prunus pensylvanica L.f.) (Table 3). Some of these trees were residuals and some were suckers, sprouts, and seedlings that came up after clearcutting.

Unfortunately there were no red maples (Acer rubrum L.), a difficult-to-kill species, in the Roundup plot

[2] Spots or squirts of liquid herbicide on the ground around the base of the tree to be removed are often absorbed by the roots of adjacent trees that you want to leave as crop trees, killing or damaging them, hence the lack of selectivity.

and only one in the Garlon plots. Small red maples were susceptible to Velpar; large ones were intermediate.

Krenite and Hyvar were mostly ineffective.

Spot Gun

Velpar and Hyvar were only moderately effective. Aspen and pin cherry were susceptible; fir and red maple were resistant (Table 3).

Gridballs

Only pin cherry and perhaps sugar maple (A. saccharum Marsh.) (one tree) were susceptible to the Velpar gridballs. White birch was intermediate. Fir, spruce, red maple, and striped maple (A. pensylvanicum L.) were resistant.

DISCUSSION

Of the five herbicides tried on these small plots, Roundup injected with the hypo-hatchet is the most promising for both cleaning young stands and killing unwanted, residual trees on cutover areas. It is effective at a low rate (20% solution, 2 mL per 2 to 3 inches dbh), economical, and worth trying on a larger scale. In subsequent trials, more red maple should be treated, and herbicides should be applied at different seasons of the year. If herbicides can be used effectively in different seasons, work flexibility would be increased.

Thinning or cleaning with herbicide and hypo-hatchet was faster than with a brush saw, and the cost of equipment is less. But thinning with herbicides is more difficult because it is hard to remember and almost impossible to see which trees were treated, in contrast to cutting where only crop trees still stand. A bright coloured dye in the herbicide mix and working backwards in narrow strips would make treated trees easy to detect and hence should improve spacing and production.

The hypo-hatchet while reasonably satisfactory if well cared for, could be improved. The average output of herbicide per hack or cut was 2 mL, not the slightly more than 1 mL claimed, and this probably varied so that some trees received less and some more than planned. The force and direction of the blow also has some effect on the output and the amount of liquid injected into the tree. The plastic bottle that holds the herbicide would be more convenient to use if it had a clear strip for viewing the level of the liquid, and was graduated in millilitres.

Finally, it should be noted that trees in the 1-inch dbh class always received the high rate of herbicide application: they can only be hacked once and should receive no less than 2 mL. Trees in the 2-inch class usually received a higher rate for the same reason. This could be overcome by having an injector with an easily adjustable rate of discharge.

REFERENCES

Mann, W.F. Jr. 1979. Glyphosate is highly effective for tree injection. USDA, For. Serv., South. For. Exp. Stn., New Orleans, La. Paper SO-150, 7 p.

Table 2. Summary of data from herbicide trials to clean a young stand along the Wapske Road, N.B.

Herbicide	Application method and rate	Plot Number	Plot Area (m^2)	Trees: Species	Trees: DBH range (inches)	Trees: Total number	Percentage of trees in classes 3 - 5 (medium damage to dead)	Condition rating	Comment
Roundup, 20% solution	Hypo-hatchet, 2 mL per 3" dbh	1a	48	Fir	2-6	3	67	Susceptible (S)	Low rate satisfactory
				Spruce	1-3	14	86	S	
		7	144	Fir	1-6	31	74	S	
				Spruce	1-5	15	60	Intermediate (I)	
				White birch	1-2	5	100	S	
				Aspen	1-4	4	100	S	
	2" dbh	1b	48	Fir	1-3	3	67	S	
				Spruce	1-2	11	91	S	
	1" dbh	1c	48	Fir	1-2	3	0	Resistant (R)	High rate unnecessary
				Spruce	1-4	16	75	S	
				Alder	1-2	6	100	S	
				White birch	2	1	100	S	
Krenite, pure	3" dbh	2a	72	Fir	1-6	7	100	S	Most species susceptible
				Spruce	2	1	0	R	
				Red pine	3	1	100	S	
	2" dbh	2b	72	Fir	1-3	8	88	S	
				Spruce	2-4	4	75	S	
				Tamarack	1	1	100	S	
				White birch	1-3	4	100	S	

Table 2 (cont.)

Herbicide	Application method and rate	Plot Number	Plot Area (m^2)	Trees Species	Trees Dbh range (inches)	Trees Total number	Percentage of trees in classes 3 to 5 (medium damage to dead)	Condition rating	Comment
Velpar, pure	3" dbh	3a	72	Fir	1-4	7	0	R	Ineffective, except on white birch
				Spruce	1-4	5	0	R	
				Red pine	2	1	0	R	
				White pine	2	1	0	R	
	2" dbh	3b	72	Fir	1-6	7	0	R	
				Spruce	1-5	16	0	R	
				White birch	1-2	3	100	S	
Hyvar, pure	3" dbh	4a	72	Fir	1-2	6	0	R	Mostly ineffective
				Spruce	1-4	24	25	R	
	2" dbh	4b	72	Fir	1	6	0	R	
				Spruce	1-4	8	50	I	
Garlon, pure	3" dbh	5a	72	Fir	1-6	5	40	I	Only white birch susceptible
				Spruce	1-2	15	13	R	
				White birch	1-2	2	100	S	
	2" dbh	5b	72	Fir	1-5	5	20	R	
				Spruce	1-5	39	23	R	

Table 2 (cont.)

Herbicide	Application method and rate	Plot Number	Plot Area (m^2)	Trees Species	Trees DBH range (inches)	Trees Total number	Percentage of trees in classes 3 to 5 (medium damage to dead)	Condition rating	Comment
	Spot Gun,								
Velpar, pure	8 mL per 1" dbh	6a	72	Fir	1-8	8	38	I	Mostly effective, but kills and damages more trees than intended because of method of application.
				Spruce	1-5	16	50	I	
				White birch	1-2	3	100	S	
				Aspen	3	1	100	S	
Hyvar, pure	1" dbh	6b	72	Fir	1-3	24	25	R	Fir resistant, otherwise similar to Velpar, above.
				Spruce	1-6	19	100	S	
				Tamarack	1	1	100	S	
				White birch	1	3	100	S	
				Aspen	2-4	2	50	I	

Table 3. Summary of data from herbicide trials to rid a clearcut area along the Odell River Road, N.B. of residual trees and unwanted new growth

Herbicide	Application method and rate	Plot		Trees			Percentage of trees in classes 3 to 5 (medium damage to dead)	Condition rating	Comment
		Number	Area (m^2)	Species	DBH range (inches)	Total number			
	Hypo-hatchet								
Roundup, 20% solution	2 mL per 3" dbh	3	144	Alder	1	3	0	R	Most species susceptible
				Aspen	5	1	100	S	
				White birch	1-6	13	69	S	
				Pin cherry	1-5	10	100	S	
				Willow	2	2	0	R	
Krenite, pure	2" dbh	1	144	Black ash	4	1	0	R	Most species resistant
				Aspen	1-4	28	57	I	
				White birch	1-7	6	17	R	
				Red maple	1-11	8	25	R	
Velpar, pure	2" dbh	7	144	Aspen	1	2	100	S	Most species susceptible.
				White birch	1-2	9	67	S	Large red maple, resistant.
				Red maple	1-12	17	94	S	
				Striped maple	1	4	100	S	
Hyvar, pure	2" dbh	6	144	White birch	1-2	2	50	I	
				Red maple	8-12	3	0	R	Large red maple, resistant
				Striped maple	1	1	100	S	

Table 3. (contd.)

Herbicide	Application method and rate	Plot Number	Plot Area (m^2)	Trees Species	Trees DBH range (inches)	Trees Total number	Percentage of trees in classes 3 to 5 (medium damage to dead)	Condition rating	Comment
Garlon, pure	3" dbh	4a	72	Alder	1	1	100	S-I	Most species intermediate or resistant
				White birch	2-5	6	50	I	
				Yellow birch	1	2	0	R	
				Pin cherry	1-4	8	63	I	
				Willow	2	1	0	R	
	2" dbh	4b	72	White birch	1-6	14	86	S	Most species susceptible
				Pin cherry	1-5	9	89	S	
				Red maple	5	1	100	S-I	
				Striped maple	1-4	4	100	S	
	Spot Gun								
Velpar, pure	4 mL per spot at 6' square spacing, plus extra for large trees	2b	72	Fir	1-6	6	0	R	Fir, red maple and striped maple are resistant
				Cedar	7	1	100	S-I	
				Aspen	2	2	100	S	
				White birch	1-8	2	50	I	
				Pin cherry	1	46	93	S	
				Red maple	1-8	9	0	R	
				Striped maple	1	4	0	R	

Table 3. (contd.)

Herbicide	Application method and rate	Plot Number	Plot Area (m^2)	Trees Species	Trees DBH range (inches)	Trees Total number	Percentage of trees in classes 3 to 5 (medium damage to dead)	Condition rating	Comment
Hyvar XL, pure	8 mL per spot at 6' square spacing, plus extra for large trees	2a	72	Fir	4-5	5	0	R	Fir and red maple are resistant
				Spruce	1	1	100	S	
				Aspen	1	1	100	S	
				White birch	1-6	2	50	I	
				Pin cherry	1-2	28	93	S	
				Red maple	1-6	9	11	R	
				Striped maple	1	2	100	S	
	Gridballs								
Velpar	20 lbs per acre (one ball at 4.25' square spacing)	5	144	Fir	1-5	16	0	R	Only pin cherry susceptible, and perhaps sugar maple (only one tree)
				Spruce	1	6	0	R	
				White pine	1	1	0	R	
				White birch	1	10	50	I	
				Pin cherry	1	24	96	S	
				Red maple	1	4	50	R-I	
				Sugar maple	1	1	100	S	
				Striped maple	1	16	31	R	

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